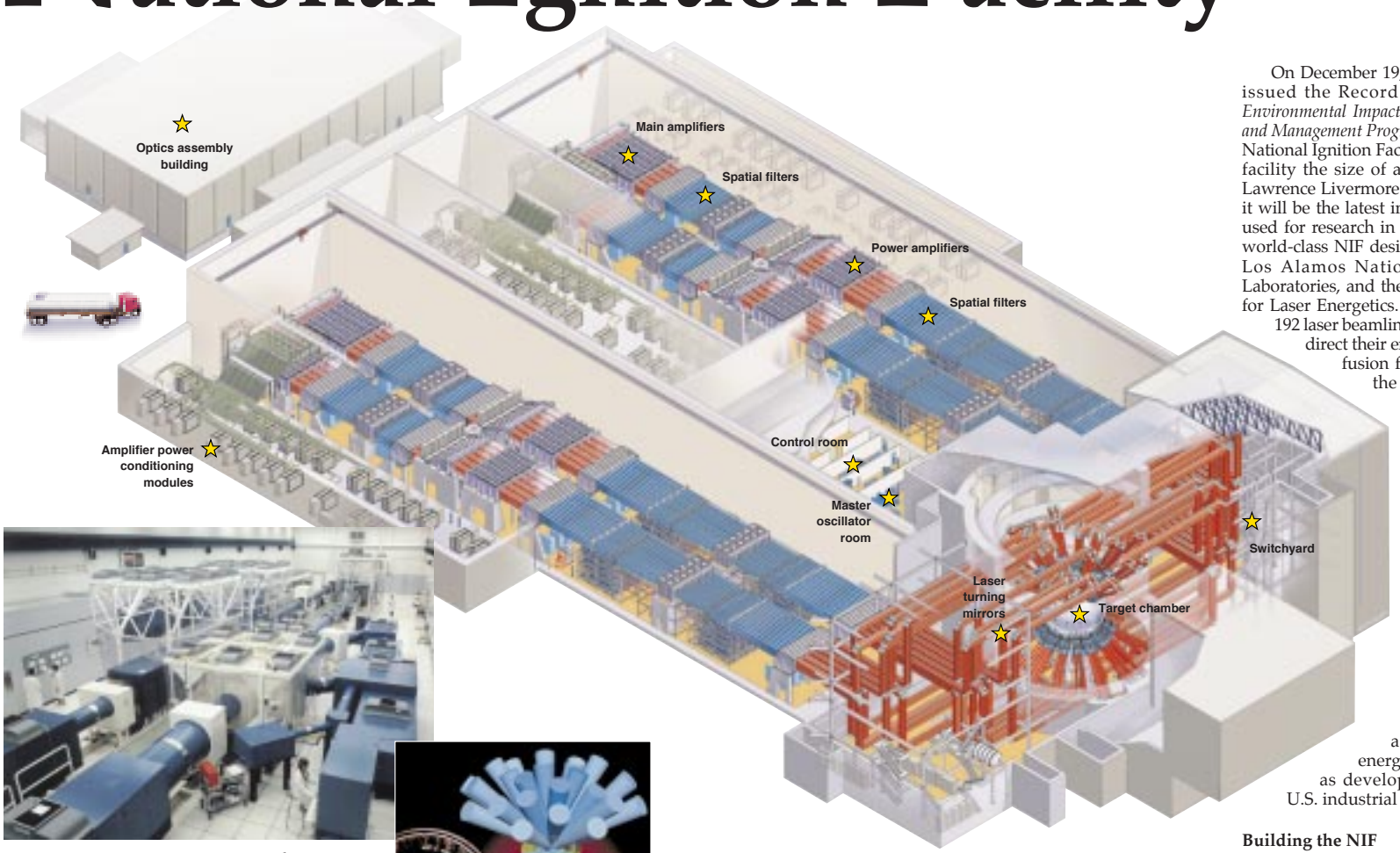
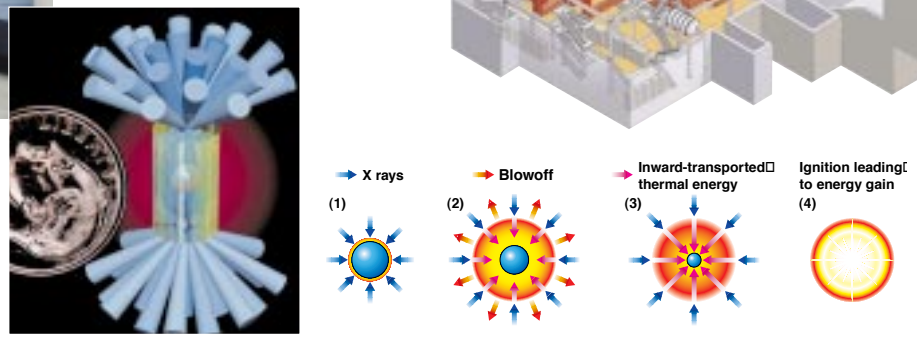
National Ignition Facility



Beamlet is a scientific prototype for one of the 192 beamlines of the NIF. Beamlet has already demonstrated the NIF single-beam laser requirements. By incorporating advanced optics and material developments, Beamlet's design is 20 times more compact than that of the Nova laser, currently the primary inertial confinement fusion research tool at LLNL.



In inertial confinement fusion, laser beams energize the inside of a hohlraum target, a dime-sized cylinder that holds a BB-sized fusion fuel capsule. The inside surface of the hohlraum then radiates x rays that rapidly heat the capsule (1), causing the capsule's surface to fly outward (2). The resulting force compresses the capsule's fusion fuel (hydrogen isotopes), raising core temperatures to 100,000,000°C. This ignites the fusion fuel (3) and produces a fusion energy output (4) many times the laser energy input (energy gain). The NIF will also have the option to illuminate the capsule (1) directly with laser beams rather than indirectly with x rays. This additional capability of direct illumination, as well as indirect illumination, will provide critical information in support of inertial fusion energy (IFE) development.

On December 19, 1996, the U.S. Department of Energy issued the Record of Decision for the *Programmatic Environmental Impact Statement for the Stockpile Stewardship and Management Program*,* approving the construction of the National Ignition Facility (NIF). The NIF, a $1.2-billion laser facility the size of a football stadium, will be located at Lawrence Livermore National Laboratory (LLNL),** where it will be the latest in a series of high-power laser facilities used for research in inertial confinement fusion (ICF). The world-class NIF design team includes experts from LLNL, Los Alamos National Laboratory, Sandia National Laboratories, and the University of Rochester's Laboratory for Laser Energetics. When completed, the NIF will house 192 laser beamlines that run the length of the facility and direct their energy inside the target chamber upon a fusion fuel capsule (bottom) the size of a BB; the Beamlet laser (far left) is a working prototype of one NIF beamline.

The NIF and National Security

Because the NIF will create physical conditions that occur only in the sun and in nuclear weapons, it is a key element in our country's Stockpile Stewardship and Management Program, which aims to maintain confidence in the safety and reliability of the U.S. nuclear weapons stockpile under a Comprehensive Test Ban Treaty. Stockpile stewardship will depend heavily on the use of NIF experimental data to verify complex computer simulations. The NIF will also be used for research in fusion energy (bottom) and basic sciences, as well as developing technologies that will enhance U.S. industrial competitiveness.

Building the NIF

The NIF has satisfied the National Environmental Policy Act process. Construction of the facility is scheduled for completion in 2003 with partial operations starting in 2001. Over 75% of the project's $1.2 billion cost will be spent in construction and manufacturing industries. This intense effort will create over 6,000 jobs around the country, including 2,800 in the San Francisco Bay Area. The NIF will push many of its industrial partners' technology capabilities to new levels, raising their international economic competitiveness. In addition, the spin-off technologies generated by the NIF are likely to have a significant positive impact on U.S. industry.

* http://www.dp.doe.gov/
** http://lasers.llnl.gov/

Work was performed under the auspices of the U.S. DOE by LLNL under contract No. W-7405-ENG-48

40-00-0295-0563C 3/97